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Gendered Perspectives of Trees on Farms in Nicaragua: Considerations for Agroforestry, Coffee Cultivation, and Climate Change

Working Paper

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Gendered Perspectives of Trees on Farms in Nicaragua: Considerations for Agroforestry, Coffee Cultivation, and Climate Change

Tatiana Gumucio, Jennifer Twyman, and Mónica Clavijo

Tatiana Gumucio is a gender postdoctoral fellow in the Decision and Policy Analysis (DAPA) Research Area at the International Center for Tropical Agriculture (CIAT) in Cali, Colombia. She is also the CIAT Gender Focal Point for the CGIAR Research Program on Forests, Trees and Agroforestry (FTA).
Email: t.gumucio@cgiar.org

Jennifer Twyman is a social scientist at CIAT in Cali, Colombia. Her research focuses on gender analysis within the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).
Email: j.twyman@cgiar.org

Mónica Clavijo is an economist graduated from the Universidad Nacional de Colombia (UNAL) and currently works as an Independent Consultant, based in Bogotá, Colombia.
Email: mmclavijor@unal.edu.co

CIAT 50 1967–2017

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Centro Internacional de Agricultura Tropical
International Center for Tropical Agriculture
Headquarters and Regional Office for Latin America and the Caribbean
Km 17 Recta Cali-Palmira CP 763537
P. O. Box 6713
Cali, Colombia
Phone: 57 2 4450000
Fax: 57 2 4450073
E-mail: t.gumucio@cgiar.org
Website: www.ciat.cgiar.org

CIAT Publication No. 432
January 2017

Gumucio T; Twyman J; Clavijo M. 2017. Gendered perspectives of trees on farms in Nicaragua: Considerations for agroforestry, coffee cultivation, and climate change. Working Paper. International Center for Tropical Agriculture (CIAT); CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS); CGIAR Research Program on Forests, Trees and Agroforestry (FTA). Cali, Colombia. 16 p.

This research was carried out by CIAT as part of the CGIAR Research Program on Forests, Trees and Agroforestry (CRP-FTA). This collaborative program aims to enhance the management and use of forests, agroforestry and tree genetic resources across the landscape from forests to farms. CIFOR leads CRP-FTA in partnership with Bioversity International, CATIE, CIRAD, CIAT and the World Agroforestry Centre.

This work was also implemented as part of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), which is carried out with support from CGIAR Fund Donors and through bilateral funding agreements. For details, please visit https://ccafs.cgiar.org/donors. The views expressed in this document cannot be taken to reflect the official opinions of these organizations.

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Acknowledgments

We wish to thank the Fundación para el Desarrollo Tecnológico Agropecuario y Forestal de Nicaragua (FUNICA) for their help with data collection, and the communities of Tuma La Dalia for their collaboration. We also gratefully acknowledge the helpful comments from Ann Tickamyer on initial data analyses and results.

Abstract

Due to gender-specific roles and responsibilities, men and women face varying challenges and opportunities to mitigate and adapt to climate change impacts. It is particularly important to take into account the ways that men and women engage with tree resources in order to develop both equitable and effective interventions and strategies, recognizing that agroforestry is an important element of these. For instance, agroforestry is often included among the recommended climate-smart agricultural practices for high value tree crops, like coffee.

The paper analyzes household level socioeconomic data collected in 2015 within a Climate-Smart Village of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) in Tuma La Dalia, Nicaragua, where smallholder shade coffee production is a substantial economic activity. The area is also part of a Landscape Observatory of the CGIAR Research Program in Forests, Trees and Agroforestry (FTA). The survey instrument developed is based on the Women's Empowerment in Agriculture Index (WEIA). From 271 households, a total of 493 surveys were carried out with adult men and women primary decision-makers. The intra-household survey collected data related to agricultural and agroforestry activities, and sex-disaggregated data on decision-making. The report provides initial insights into the uses and importance that women and men associate with trees on farms, as well as their participation in decision-making on agroforestry activities, in order to support the development of gender-sensitive climate change interventions focused on high value tree crops. In particular, findings suggest that women associate a greater number of household uses with on-farm trees than men. Furthermore, women may be more prone to give importance to fruit trees in comparison to men. Results also demonstrate differences in women's and men's perceptions of decision-making processes concerning trees on farms: women recognize their participation more than men, particularly when it concerns fruit trees and planting, as opposed to tree management.

Keywords

Gender, agroforestry, Nicaragua, climate change.

1. Introduction

Management of forests and trees on farms constitute key strategies for climate change mitigation and adaptation, with critical implications for the diverse numerous populations who depend on forest and tree resources for their livelihoods. Men and women face varying challenges and opportunities to mitigate and adapt to climate change impacts due to gender-differentiated roles and responsibilities (Brody et al. 2008, Lambrou and Piana 2006, Rodenberg 2009). A research lens that takes into account gender-differentiated ways of engaging with forest and tree resources is important for the development of climate change interventions that promote equitable benefit distribution, harness producers' innovative capacities and consequently, create long-term positive mitigation and adaptation effects.

Consideration of gender aspects can be all the more important in Latin America, where the largest forest extensions exist currently (Mai et al. 2011). Research in Latin America suggests that gender differences exist in the uses and values given to forest and tree resources, and the corresponding ecosystem services. In the Amazonian region, women may prioritize a wider diversity of forest products including those used for nutrition, cultural purposes, and medicine, in comparison to men (Shanley et al. 2011, Bolaños and Schmink 2005). Research on cocoa agroforestry producers in Ecuador furthermore suggest that women might value the non-monetary benefits of agroforestry, such as those related to organic material, biodiversity, and subsistence crops, more than men (Blare and Useche 2015). Furthermore, a study in the western region of El Salvador suggests that both men and women household heads value equally the shade, fruit crop systems, and ecosystem services benefits of forest cover, and fruit agroforestry is particularly well-suited to women as it can be engaged in near the home (Kelly 2009).

In Latin America and cross-regionally, it is important to recognize men's and women's contributions to smallholder production systems and decision-making power in order to promote successful adoption of climate-smart agricultural (CSA) practices, including those related to agroforestry. Research on spousal involvement in decision-making processes on tree planting and management in Malawi finds that, although men may more frequently make the decisions, more trees tend to be planted in households where the wife makes decisions on tree planting and also in households where both husband and wife make decisions on tree management (Meijer et al. 2015). Research in Vietnam suggests that women may often be more interested than men in agroforestry, although women's lack of access to productive resources can inhibit adoption (Catacutan and Naz 2015). For example, due to the targeting of men in extension programs that promote agroforestry systems, women might prefer monoculture palm oil plantations more than men in some instances in Indonesia (Koczberski 2007). Furthermore, male migration due to climate change impacts has contributed to the increase of women's on-farm labor burdens and may enhance their role in agricultural decision-making processes in various regions of the world most vulnerable to climate change impacts (Djoudi and Brockhaus 2011, Valdivia et al. 2013).

Such gender considerations are important to take into account for effective mitigation and adaptation interventions. Research suggests that coffee agroforestry producers in Latin American countries derive significant commercial and subsistence value from the non-coffee products of the agroforestry system, for example, timber, fuelwood, and fruits (Rice 2008, 2011). However, there is a lack of consideration of gender aspects within the research, for example, how uses derived from the agroforestry system may vary between men and women producers. Similarly, a study on home gardens in an area of Nicaragua where the principal agricultural products are coffee, ornamentals, and fruit trees demonstrates the multi-functionality of home gardens, including subsistence and income generation; notwithstanding, the research neglects to assess more in-depth the influence of socio-economic variables on the purposes that the agroforestry system serves to farmers (Mendez et al. 2001).

Cora (1999) analyzes the benefits and functions that men and women associate with shade trees in coffee systems in North Nicaragua, with the purpose of identifying farmer typologies and providing recommendations for targeted extension services. While providing important gender analysis on coffee

farmers' perceptions related to the agroforestry system, the study is limited to a relatively small sample size over a wide area and is restricted from taking into account intersecting variables such as wealth, age, education, and degree of involvement in coffee production. The study also does not explore women's and men's perceptions in relation to agricultural and agroforestry practices, and it can furthermore merit an updated application to a context of climate change impacts.

The present study begins to address these knowledge gaps. Agroforestry is upheld as an integral means for smallholder farmers to mitigate and adapt to climate change impacts; it is often included as a recommended CSA practice for high value crops like coffee, which can be an important commercial product for smallholder farmers in areas vulnerable to climate change impacts. It is critical to take into account women's and men's interests, preferences, and decision-making roles in order to promote effective and equitable adoption of CSA practices related to trees on farms. Using data collected from Tuma la Dalia, a coffee-producing region of Nicaragua, the paper has dual objectives: to analyze the influence of gender on the uses and importance that smallholder farmers associate with trees on farms, taking into account additional socio-economic variables; and to analyze men's and women's contributions to decision-making processes associated with trees-on-farms. The paper also explores the relationship of gender empowerment indicators such as group membership and participation in decision-making with implementation of CSA practices related to tree and forest management.

The results provide initial considerations for the development of gender-sensitive climate change interventions focused on agroforestry systems with coffee. For example, it is important to consider how increased involvement in coffee cultivation may influence smallholders to favor timber trees on farms more, although fruit trees might be more beneficial to women primary decision-makers from less wealthy households for purposes of food security. Furthermore, depending on the types of trees introduced on farms, women may be more or less limited from participating in decision-making on their cultivation.

2. Methods

The study uses data collected in 2015 through an intra-household survey of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) in Tuma la Dalia, Nicaragua. The area constitutes a CCAFS Climate-Smart Village, a territory distinguished by high climatic risk and wherein CCAFS partners have established strong links with local communities. It also coincides with the Nicaragua-Honduras Sentinel Landscape of the CGIAR Research Program on Forests, Trees and Agroforestry (FTA). From 271 households, a total of 493 surveys were carried out with adult men and women who identified themselves as household members who were primarily responsible for agricultural decision-making. Households were chosen through simple random sampling.

At the beginning of each survey, interviewers requested confirmation that respondents were indeed those who principally made decisions in the household; this verification was particularly important in households where the man and woman primary decision-makers were not obvious, as in households not headed by a conjugal or consensual couple. In general, there were no cases of households headed by two people wherein only one person was interviewed. In this way, a total of 239 men and 241 women were interviewed.

In addition to personal and household characteristics, the intra-household survey collected data related to agricultural and agroforestry activities and sex-disaggregated data about decision-making and adoption of CSA practices. Questions related to trees were developed from FAO's National Forest Monitoring and Assessment (NFMA) Manual for integrated field data collection, Land Use/Cover Class – Products and Services (2009). In particular, respondents were asked to list all the trees existing on their farms and the uses given to each one. Respondents were also asked to rank the three trees that were most important to their households. Common names of the trees reported were documented. For uses, respondents were given a list of options, also based on the NFMA.[1] Finally, respondents were asked to list all the individuals involved in labor and decision-making (for three agroforestry activities and two related to income) related to the three most important trees on their farms.

In particular, survey questions address the five domains used for measurement by the Women's Empowerment in Agriculture Index (WEIA), a new tool developed by the International Food Policy Research Institute (IFPRI) and used by USAID in Feed the Future countries. These domains are production, resources, income, leadership, and time (Alkire et al. 2013). The present paper only looks at production (participation in agricultural decision-making) and leadership (group membership) as empowerment indicators and their relationship with adoption of CSA practices; however, a more comprehensive study of the data as it relates to empowerment can be the subject of future research.

Tests of differences of proportions in independent samples were used to test the association between explanatory variables (gender, age, education, land area, area dedicated to coffee cultivation) and tree rankings. These were also used to test the association between explanatory variables and tree uses. Two sample T-tests (after determining different/equal variance) were carried out to test the association between number of on-farm tree species and women's empowerment indicators (group membership and participation in decision-making). Chi-squared tests were also used to test the association between adoption of CSA practices related to tree and forest management and women's empowerment indicators.

[1] This list was adjusted during piloting of the survey tool, for example, to include "reforestation" and "shade" as options after these were given frequently by respondents as answers to the survey question.

3. Results

3.1 Household characteristics of the study group

The average household size of our sample was 4-5 people, with an average of three children (Twyman et al. forthcoming). The average age of household members was 48, with 72% of men and 79% of women primary decision-makers being under 54, respectively. Eighty-five percent of women and 92% of men primary decision-makers had at least a primary school education level. Eighty-nine percent of all households owned land, with an average total farm size of 3.4 hectares. Fifty percent of land-owning households had less than 2 hectares of land total. Principal land uses include cultivation of maize, coffee, beans and home gardens. In particular, 54% of households cultivated coffee, dedicating an average of 0.9 hectares total to coffee production. On average, households have 14-15 tree species on farms. The most frequently reported tree species on farms included fruit trees (mango, avocado, orange, lemon, tangerine, guayaba, nancite), timber trees (laurel, coyote, cedar), and multi-purpose trees (guacimo, guaba, madero negro). For the purposes of reporting results, trees are categorized according to fruit, timber and multi-purpose throughout the remainder of the discussion.

3.2 Tree uses

In general, women and men respondents tended to coincide in the uses associated with trees on farms, although some significant differences did arise. Table 1 below summarizes uses reported, according to fruit and timber or multi-purpose trees. Women and men both name food for home consumption as the most frequent household use for fruit trees. They also named shade, fuel, and construction material most frequently as uses for timber or multi-purpose trees. In particular, women tended to name reforestation more frequently than men for all types of trees (22% of women vs. 15% of men for fruit trees; and 56% of women vs. 31% of men for timber or multi-purpose trees). They also tended to name medicinal plant usage more frequently than men, for all types of trees. With respect to fruit trees in particular, women mentioned more frequently than men the use of gifting products to neighbors; they also reported fuelwood and shade for fruit trees more frequently than men.

Table 1: Uses associated with trees by percentage of men and women respondents

Use	Fruit		Timber or multi-purpose	
	Women (n=254)	Men (n=239)	Women (n=254)	Men (n=239)
Fuel	24%*	8%	75%	74%
Commercial products	37%	33%	1%	0%
Food home consumption	94%	95%	25%	20%
Shade	54%*	38%	84%	79%
Reforestation	22%*	15%	56%*	31%
Gift	37%*	14%	1%	0%
Medicinal plants	23%*	0%	7%*	1%
Construction material	9%	6%	59%	55%
Wood pieces	4%*	0%	22%	16%
Forage	1%	0%	4%	3%
Utensils, artisanry	0%	0%	0%	2%*
Ornamentals	6%	10%	4%	8%*
Fertilizers	0%	0%	2%	0%
Other use	0%	3%*	17%	18%

* Statistically significant difference (unilateral difference of proportions with $p<0.05$)

Furthermore, women report more uses than men. Twenty-seven percent of women vs. 10% of men associated three to 5 distinct uses with the group of fruit trees; 15% of women vs. 4% of men associated six distinct uses or more with the group of timber and multi-purpose trees. Chi-squared tests show that the differences are statistically significant ($p < .05$). A unilateral test confirmed the direction of the difference, for the association of six or more uses with timber and multi-purpose trees (diff>0). Figure 1 summarizes the number of uses associated with each tree category per women and men respondents.

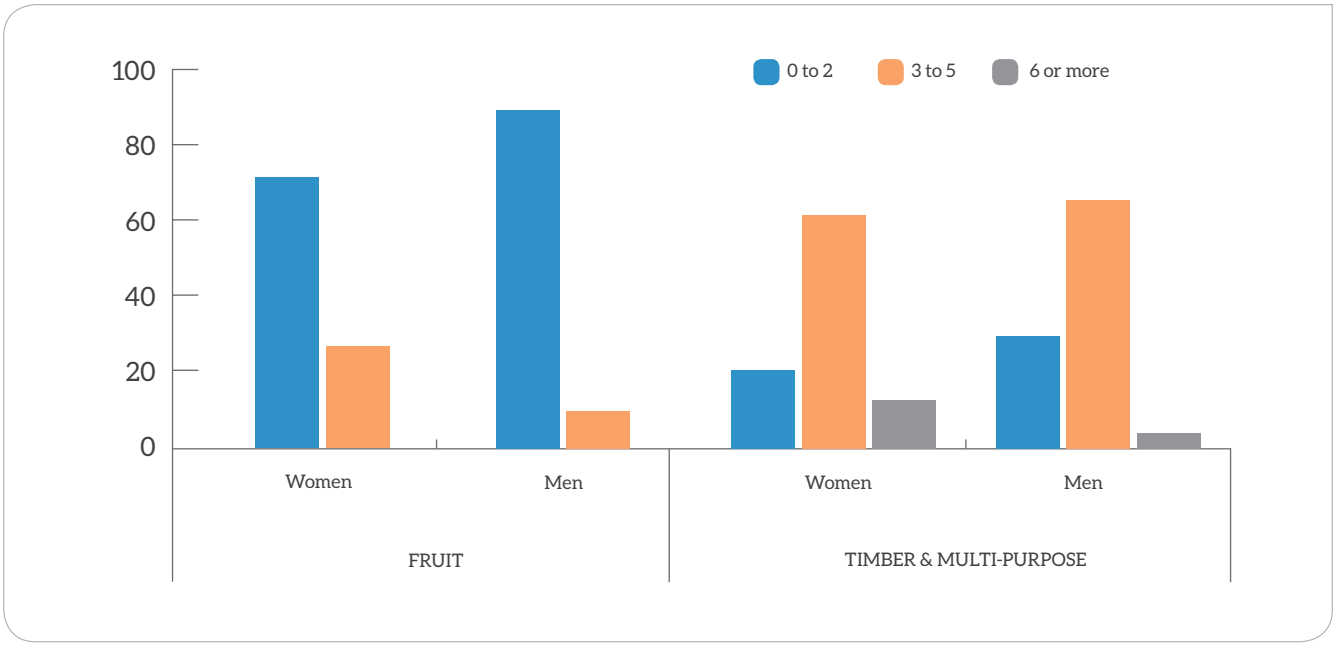

Figure 1: Number of distinct uses associated with fruit trees and timber and multi-purpose trees per women and men respondents

Table 2 gives a summary of the most commonly reported tree species by both men and women respondents, for the most frequently reported uses. While this is meant to represent commonalities across all respondents, it is important to take into account that gifting and medicinal plant uses are reported mostly by women.

Table 2: Trees most commonly reported by respondents, for primary uses cited

Uses	Commonly reported tree species
Fuel	Guácimo, madero negro, guaba
Commercial products	Cacao, achiote, avocado
Food home comsuption	Guayaba, orange, lemon, tangerine, nancite, mango, avocado
Shade	Guaba, laurel
Reforestation	Cedar, guaba, laurel, coyote
Gift	Orange, lemon, tangerine, mango, avocado, nancite
Medicinal plants	Lemon
Construction material	Laurel, coyote, cedar

3.3 Rankings

When respondents were asked to rank the three most important trees for their households, both men and women tended to name timber trees as the most important. Table 3 summarizes the percentages of women and of men respondents that named a fruit, multi-purpose, or timber tree as the 1st, 2nd, and third most important for the household. For the first tree, 50% of women and 68% of men named a timber tree. The tendency to name timber trees diminishes and fruit trees are mentioned more, by both men and women, as the 2nd and 3rd most important trees are listed. Tendencies to name multi-purpose trees remain about the same, although they may increase slightly for the 2nd and 3rd ranked tree. Some statistically significant differences appear between men's and women's responses, for example: women tend to name fruit trees more frequently than men, although this difference diminishes for the third most important tree ($p < .05$).

Table 3: Most important trees to the household by women and men respondents

		Women	Men
Tree 1	Fruit	45%*	29%*
	Multi-purpose	5%	3%
	Timber	50%	68%
	Total	247	233
Tree 2	Fruit	46%*	31%*
	Multi-purpose	8%	6%
	Timber	46%	63%
	Total	246	232
Tree 3	Fruit	51%*	42%*
	Multi-purpose	8%	9%
	Timber	42%	49%
	Total	245	230

* Statistically significant difference in test of proportions ($p<0.05$).

In order to determine the association of age of men and women respondents with tree rankings, four approximately equally proportioned age groups were identified; however, chi squared tests of the relation between age groups and proportions of trees reported as 1st, 2nd and 3rd most important failed to show any significant differences. Similarly, tests to determine the association of education level of men and women respondents with tree rankings found no significant differences. This last observation is understandable, as there is not much variation in education level among men and women respondents; the majority are literate or have a primary school education.

In contrast, when gender groups were stratified by total household farm size, tests of association of total household farm size of men and women respondents with tree rankings showed various significant differences. Quantiles of respondents' total household farm size were established, as shown below:

Table 4: Distribution of total farm area (in hectares) by quantiles

	Minimum	Maximum	No. Households
Quantile 1	0	0.3513	64
Quantile 2	0.3513	1.9321	57
Quantile 3	1.9321	3.8643	62
Quantile 4[2]	3.8643	35.13	57

[2] It is worth considering that the households with the largest total farm size in this quantile may be outliers. The distribution of total farm area shows that approximately 6% of households have total farm area over 10 hectares, atypical given the sample distribution. With respect to these households (17 total), respondents named land uses for crop production but also pastures and forests. They also mentioned having dairy and beef cattle. For this reason, it is likely that these households alternate land use among other activities like livestock production and forest conservation.

Table 5 summarizes women's and men's responses, per quantile of total household farm area, regarding the 1st, 2nd and 3rd most important tree to the household. In general, men and women respondents named timber trees more frequently, in comparison to fruit and multi-purpose trees, as the 1st and 2nd most important trees for the household. This frequency increases as land size increases, and is highest for the third quantile of total farm area. Multi-purpose trees tend to be named least frequently, and their frequencies tend to remain the same across quantiles, although they are reported as important slightly less as farm size increases. It is important to note, here, that multi-purpose trees have a significant use as fuel. They tend to be named slightly more as the 2nd and 3rd most important trees. Also, for the category of 3rd most important tree, the difference in frequencies between fruit and timber trees becomes less pronounced.

Significant differences ($p < .05$) were found with respect to the tree ranked most important to the household, among the first three quantiles of farm area: for each quantile, women tended to report fruit trees more frequently than men. Also, women in the third quantile tend to name timber trees more frequently than women in the first quantile. For the tree ranked 2nd most important, women in the quantiles of smallest total farm area (quantiles 1 and 2) tend to name fruit trees more frequently than men in this quantile. Additionally, both women from the 2nd and 3rd quantiles tend to name timber trees more frequently than women from quantile 1.

Table 5: Most important trees to the household by women and men respondents and by total farm area

		Tree 1		Tree 2		Tree 3	
		Women	**Men**	**Women**	**Men**	**Women**	**Men**
Quantile 1	Fruit	46%*	30%*	57%*	38%*	59%	51%*
	Multi-purpose	8%	0%	16%	7%	10%	13%
	Timber	46%**	70%	28%**	55%	31%	36%
	Total	63	64	58	55	58	55
Quantile 2	Fruit	42%*	19%*	44%*	25%*	47%*	33%
	Multi-purpose	5%	4%	7%	8%	9%	10%
	Timber	53%	77%	49%**	67%	44%	56%
	Total	57	57	55	48	55	48
Quantile 3	Fruit	31%*	21%*	37%	25%*	48%	36%
	Multi-purpose	2%	2%	6%	3%	4%	7%
	Timber	68%**	77%	57%**	69%	48%	58%
	Total	62	62	54	59	54	59
Quantile 4	Fruit	40%	32%	43%	31%	46%	44%
	Multi-purpose	5%	5%	2%	4%	9%	8%
	Timber	54%	63%	55%	65%	45%	48%
	Total	57	57	56	51	56	50

*** Statistically significant difference between women and men within the quantile ($p<0.05$).**
**** Statistically significant difference within gender group across quantiles ($p<0.05$).**

Fewer trends with statistical significance appeared when the association of coffee cultivation with tree rankings was tested. Two groups of "with coffee crops" and "without coffee crops" were established, according to whether or not the household dedicated any land area to coffee cultivation. Table 6 summarizes women's and men's responses, according to households with or without coffee crops, related to the 1st, 2nd and 3rd most important tree for the household. For the 1st and 2nd most important trees to the household, women and men respondents from households with coffee cultivation name timber trees most frequently. With regards to these results, it is important to consider that shade is a use that respondents frequently reported for timber trees; consequently, timber trees can be regarded as particularly critical for shade coffee production. For these households, fruit trees increase in frequency for the 2nd and 3rd rankings, and the frequencies of multi-purpose trees remain about the same, though increasing slightly for the 3rd ranked tree. In households without coffee cultivation, women report fruit trees most frequently for all rankings of trees, although the difference in frequencies between fruit and timber trees decreases for the 3rd most important tree. There is a significant difference ($p < .05$) between women from households with coffee cultivation and without cultivation with regards to the 1st and 2nd most important tree reported: women from coffee households reported timber trees more frequently.

Table 6: Most important trees to the household by women and men respondents and by coffee cultivation land use

		With coffee cultivation		Without coffee cultivation	
		Women	**Men**	**Women**	**Men**
Tree 1	Fruit	54%	34%	37%	25%
	Multi-purpose	5%	4%	6%	2%
	Timber	41%*	62%	57%*	72%
	Total	111	99	135	134
Tree 2	Fruit	51%	37%	42%	26%
	Multi-purpose	11%	4%	6%	7%
	Timber	38%*	59%	52%*	66%
	Total	111	98	135	134
Tree 3	Fruit	52%	49%	50%	37%
	Multi-purpose	5%	8%	10%	9%
	Timber	43%	42%	41%	54%
	Total	110	97	135	133

* **Statistically significant difference in test of proportions ($p<0.05$).**

3.4 Participation in decision-making

Here we summarize the results for when participants were asked to list the individuals who participated in decision-making on tree planting and tree management, for each of the 1st, 2nd and 3rd most important trees for the household.[3] Figure 2 summarizes men's and women's responses. A majority of women respondents report that women contribute to decision-making for each of the fruit trees, be it either alone or with men; in particular, women respondents report that they alone decide on planting of lemon and nancite trees (48% and 35% of women respondents, respectively). In comparison, joint participation of men and women is less in decision-making on planting of timber and multi-purpose trees; women report more frequently that men alone make these decisions. In general, men tend to report only men's contributions to decision-making on planting; for timber and multi-purpose trees in particular, they report women's participation minimally.

Responses on participation in decision-making on tree management follow similar trends, although women's participation may be reported to a lesser extent by both women and men. Figure 3 summarizes women's and men's responses. Only for the mango, tangerine, lemon, and nancite trees do a majority of women report that they participate in decision-making on management, either alone or with men. They tend to report that men alone make decisions on management for timber and multi-purpose trees. Men largely report only men's participation in decision-making for all tree categories.

[3] While questions related to harvest and sale were included, these questions may not have applied to all trees; for this reason, the report does not consider them here.

Figure 2: Women's and men's participation in decision-making on tree planting per women and men respondents

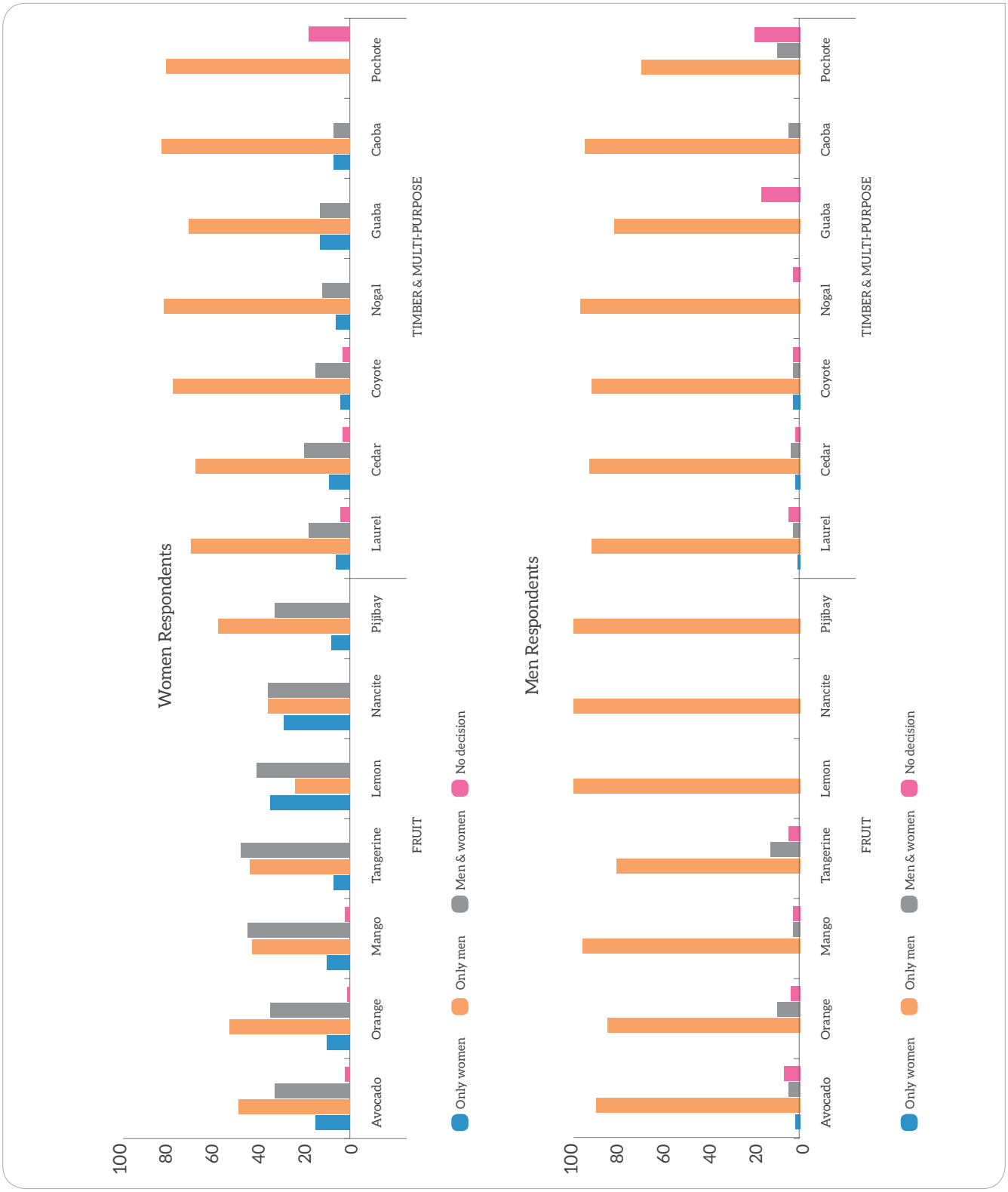

Figure 3: Women's and men's participation in decision-making on tree management per women and men respondents

3.5 Tree planting behavior

In order to test the association of women's participation in decision-making and number of tree species on farms, a variable was developed based on women's participation in decision-making on planting, management, harvest, sale, and income use. As Figure 3 suggested already, there is a significant difference between men's and women's perceptions of women's participation in decision-making, with women reporting their participation more than men. Nonetheless, two sample t-tests comparing average number of tree species on farms according to women's participation in decision-making did not give significant results.

A variable was also constructed to measure respondents' group membership (this included communal work groups, coffee or cacao cooperatives, forest management groups, women's groups). After confirming equal variance between groups of women respondents who have and who do not have group membership, a two-sample t test of mean difference showed that the average number of on-farm tree species reported was greater when women participated in groups, as compared to when they did not. (A similar t-test comparing cases wherein men do and do not participate in groups did not give significant results).

3.6 Implementation of CSA practices related to tree and forest management

A variable was developed to represent whether or not respondents reported household implementation of the following general CSA practices: agroforestry, living fences, and reforestation. Chi squared tests were used to determine the association of women's participation in decision-making with implementation of the CSA practices. Table 7 below shows the association of household adoption or not of the CSA practices with women's participation in decision-making, according to the responses of women and of men. The results show a significant relationship ($p < .05$), when comparing men who report women's participation in decision-making versus those who do not, although it is not possible to determine the direction.

Table 7: Household implementation of CSA practices vs. women's participation in decision-making per women and men respondents

Women's participation in decision-making	Women			Men		
	No adoption	Adoption	Total	No adoption	Adoption	Total
Yes	51	9	60	152	14	166
No	129	34	163	50	12	62
Total	180	43	223	202	26	228

Chi-squared tests were also carried out to determine the association between women's participation in groups and implementation of CSA practices; however, these did not show any significant relationships.

4. Discussion and conclusions

Although future research will need to look more closely at the crops or area of the farm where the particular trees are associated, in general survey results indicate significant trends with regards to the uses and importance that men and women primary decision-makers give to trees on farms. They also provide initial considerations for men's and women's participation in decision-making related to trees on farms, as well as a first exploration of the relationship of women's empowerment with regards to household tree planting behavior and implementation of CSA practices.

Women and men may coincide in the uses they associate with the fruit, timber and multi-purpose trees on their farms; however, significant differences arise, as well, aligned with trends in the literature on gender, forests, and agroforestry in Latin America. Both men and women identify food source as an important use of fruit trees and shade, reforestation, fuel, and construction material as principal uses for timber and multi-purpose trees; however, women associate reforestation with all types of trees more than men. They also name shade more frequently as a use for trees than men, although this difference is only significant for fruit trees. Additionally, women tend to identify a greater diversity of uses for the trees on their farms, than men do. Results like these suggest that women may be more prone to recognize the use of trees for restoring the forest cover than men, as well as the agro-ecological use of fruit trees, although more research on these tendencies is necessary. Furthermore, additional research is necessary in order to understand how household gender roles and gender-specific agro-ecological knowledge may influence the greater diversity of uses that women associate with trees in comparison to men.

Results also suggest that, while both men and women associate high importance with timber trees for their households, women give importance to fruit trees more frequently than men. It is possible that women's role in household meal preparation and food security explains this. Furthermore, while associations with socioeconomic variables like age and education of men and women do not result in significant differences in preferences, results suggest that total farm area (which can be thought of as an indicator for wealth) can explain the importance that smallholder farmers assign to trees on farms, for women particularly. For example, when women are from households with smaller total farm area, they tend to give less importance to timber trees in comparison to women from households of larger farm area. Land use for coffee cultivation is also a significant factor with regards to the importance that women associate with trees on farms: women from households that cultivate coffee give more importance to timber trees than women from households who do not. Such information suggests that while men may consistently give importance to timber trees, regardless of other factors such as total land area and coffee cultivation land use, these factors can influence women's perceptions of the importance of timber trees.

It is important to note that the principal uses associated with timber trees tend to be shade, construction material, and reforestation; accordingly, it is possible that these uses become important to men and women farmers, women in particular, with increased wealth and with increased land use for coffee cultivation. As a next step, assessment of the relationship between total farm area and land use for coffee cultivation will be important.

Another relevant result relates to men's and women's decision-making roles. Perceptions of participation in decision-making vary significantly between men and women. According to women, they participate more in decision-making on tree planting rather than tree management, with increased involvement where it concerns fruit trees in comparison to timber and multi-purpose trees. In contrast, men tend to report their sole participation in all decision-making and women's participation minimally; this is most prominent for decision-making on tree management. Such differences in men's and women's perceptions of participation in decision-making processes for agricultural production have been noted elsewhere, and indicates an important area for further research (Twyman et al. 2016, Twyman et al. forthcoming). Furthermore, it is possible that women's acknowledgement of their participation in decision-making for fruit trees more than timber is associated with their tendency to give importance to fruit trees more frequently than men. Again, it would be important to assess women's household obligations and social roles in order to understand this better. For example, the lemon tree's significantly reported use as a medicinal plant and for household consumption can possibly explain women's significant participation in decision-making for this tree (Table 2).

The results regarding the relationships of women's empowerment indicators with tree planting behavior and implementation of CSA practices indicate that

women's participation in groups is associated with increased on-farm tree species diversity. Also, there is a significant relationship between men's identification of women's participation in decision-making and household implementation of CSA practices, although it is not possible to determine the direction. Further data analysis and follow-up research is necessary in order to better assess who are the women who participate in groups (understanding that these were a small portion of the total sample, 48 women), as well as who are the men who recognize women's participation in decision-making. This will be important in order to identify other factors that can help explain the relationships.

The paper analyzes initial results from an intrahousehold survey on gender, agriculture, agroforestry, and climate-smart agricultural practices in order to begin to provide information on gender considerations for climate change interventions targeting agroforestry systems with coffee crops. The analyses indicate the importance of taking advantage of both women's and men's specialized agro-ecological knowledge of trees on farms, as well as their differing awareness of the multiple functions of trees for the household, to develop innovative, locally-informed, and truly climate-smart strategies.

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Headquarters and Regional Office for Latin America and the Caribbean

Km 17 Recta Cali–Palmira CP 763537
Apartado Aéreo 6713
Cali, Colombia
Phone: +57 2 4450000
Fax: +57 2 4450073
General e-mail: ciat@cgiar.org

CONTACT
Carolina Navarrete, Coordinator
✉ c.navarrete@cgiar.org

Regional Office for Africa

c/o ICIPE
Duduville Campus,
Off Kasarani Road
P.O. Box 823-00621
Nairobi, Kenya
Phone: +254 20 8632800 /
+254 719 052800 / 721 574967
Fax: +254 20 8632001

CONTACT
Adebisi Araba, Regional Director
✉ a.araba@cgiar.org

Regional Office for Asia

c/o Agricultural Genetics Institute (Vien Di Truyen Nong Nghiep), Vietnam Academy of Agricultural Sciences (VAAS), Pham Van Dong Street, Tu Liem (opposite the Ministry of Security – Doi dien voi Bo Cong An)
Hanoi, Vietnam
Phone: +844 37576969

CONTACT
Dindo Campilan, Regional Director
✉ d.campilan@cgiar.org

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